CLAIMS

What is claimed is:

1. A method for shaping a surface of a workpiece, comprising:

placing the workpiece in a plasma processing chamber including a plasma torch;

translating at least one of the workpiece and the plasma torch; and

using reactive atom plasma processing to shape the surface of the workpiece with the discharge from the plasma torch.

2. A method according to claim 1, wherein the step of using reactive plasma processing to shape the surface of the workpiece causes minimal or no damage to the workpiece underneath the surface.

3. A method according to claim 1, wherein the step of using reactive plasma processing to shape the surface of the workpiece comprises removing material from the surface of the workpiece.

4. A method according to claim 1, further comprising:

rotating the workpiece with respect to the plasma torch.

5. A method according to claim 1, further comprising:

creating a reactive species in the plasma.

6. A method according to claim 1, further comprising:

placing a precursor in a central channel of the plasma torch.

7. A method according to claim 1, further comprising:

placing a precursor in the plasma torch and creating a reactive species in the plasma.

8. A method according to claim 1, further comprising:

placing a precursor in the plasma torch.

9. A method according to claim 1, further comprising:

controlling the mass flow of a precursor into the plasma.

10. A method according to claim 1, further comprising:

controlling the mass flow of a precursor into the plasma from between about 0 ml/min to about 2,000 ml/min.

11. A method according to claim 1, further comprising:

controlling the mass flow of a precursor into the plasma from between about 0 ml/min to about 50,000 ml/min.

12. A method according to claim 1, further comprising:

selecting a concentration of precursor to be introduced into a central channel of the plasma.

13. A method according to claim 1, further comprising:

introducing a plasma gas through an outer tube of the plasma torch.

14. A method according to claim 1, further comprising:

coupling energy to the discharge in an annular region of the plasma torch.

15. A method according to claim 1, further comprising:

introducing an auxiliary gas through a second of three concentric tubes in the plasma torch.

16. A method according to claim 1, further comprising:

using an auxiliary gas to keep hot plasma away from a central channel of the plasma torch.

17. A method according to claim 1, further comprising:

using an auxiliary gas to adjust the position of a discharge.

18. A method according to claim 1, further comprising:

controlling the size of a discharge by selecting the inner diameter of

an outer tube of the plasma torch.

19. A method according to claim 1, further comprising:

introducing a plasma gas tangentially.

20. A method according to claim 1, further comprising:

metering gas flow in the plasma torch.

21. A method according to claim 1, further comprising:

maintaining the temperature of the plasma between 5,000 and 15,000 degrees C.

22. A method according to claim 1, further comprising:

producing a volatile reaction on the surface of the workpiece.

23. A method according to claim 1, further comprising:

maintaining the processing chamber at about atmospheric pressure.

24. A method according to claim 1, further comprising:

cleaning the surface of the workpiece with the plasma.

25. A method according to claim 1, further comprising:

polishing the surface of the workpiece with the plasma.

26. A method according to claim 1, further comprising:

planarizing the surface of the workpiece with the plasma.

27. A method according to claim 1, further comprising:

using a plasma torch with a multiple head to increase the plasma etch rate.

28. A method according to claim 1, further comprising:

using a precursor solution to control the etch rate of the plasma.

29. A method according to claim 1, further comprising:

using a precursor to control the etch rate of the plasma, the precursor being any one of a solid, liquid, or gas.

30. A method for cleaning a surface, comprising:

placing the workpiece in a plasma processing chamber including a plasma torch;

translating at least one of the workpiece and the plasma torch; and

using reactive atom plasma processing to remove material from the surface of the workpiece.

31. A tool for shaping the surface of a workpiece, the tool being able to

accomplish the following steps:

positioning a workpiece in a plasma processing chamber including a plasma torch;

translating at least one of the workpiece and the plasma torch; and

using reactive atom plasma processing to shape the surface of the workpiece with the discharge from the plasma torch.

32. A tool for shaping the surface of a workpiece, comprising:

means for positioning a workpiece in a plasma processing chamber including a plasma torch;

means for translating at least one of the workpiece and the plasma torch; and

means for using reactive atom plasma processing to shape the surface of the workpiece with the discharge from the plasma torch.

33. A tool for shaping the surface of a workpiece, comprising:

a plasma torch;

a translator that can translate at least one of a workpiece and said torch; and

wherein said torch is configured to shape the surface of a workpiece using a reactive plasma process.

34. A method for shaping an optic, comprising:

placing an optic workpiece in a plasma processing chamber including a plasma torch;

translating at least one of the optic workpiece and the plasma torch; and

using reactive atom plasma processing to shape the surface of the optic workpiece with the discharge from the plasma torch.

35. A method for shaping a high-damage threshold optic, comprising:

placing a high-damage threshold optic workpiece in a plasma processing chamber including a plasma torch;

translating at least one of the optic workpiece and the plasma torch; and

using reactive atom plasma processing to shape the surface of the optic workpiece with the discharge from the plasma torch.

36. A method for back-etching a wafer, comprising:

placing the a wafer in a plasma processing chamber including a plasma torch;

translating at least one of the wafer and the plasma torch; and

using reactive atom plasma processing to etch a back surface of the wafer with the discharge from the plasma torch.

37. A method for thinning a wafer, comprising:

placing the a wafer in a plasma processing chamber including a plasma torch;

translating at least one of the wafer and the plasma torch; and

using reactive atom plasma processing to remove material from a surface of the wafer with the discharge from the plasma torch.

38. A method for thinning bonded wafers, comprising:

placing the bonded wafers in a plasma processing chamber including a plasma torch;

translating at least one of the bonded wafers and the plasma torch; and

using reactive atom plasma processing to remove material from an outer surface of the bonded wafers with the discharge from the plasma torch.

39. A method for planarizing a surface of a workpiece, comprising:

placing the workpiece in a plasma processing chamber including a plasma torch, the plasma processing chamber at atmospheric pressure;

translating at least one of the workpiece and the plasma torch;

using reactive atom plasma processing to simultaneously remove material from the surface of the workpiece and redeposit the removed material back onto the surface of the workpiece.

40. A method for shaping a surface at atmospheric pressure, comprising:

placing the workpiece in a plasma processing chamber including a plasma torch, the plasma processing chamber at atmospheric pressure;

translating at least one of the workpiece and the plasma torch; and

using reactive atom plasma processing to simultaneously remove material from the surface of the workpiece and redeposit the removed material back onto the surface of the workpiece in order to shape the surface of the workpiece.

41. A method for shaping the surface of a workpiece, comprising:

positioning a workpiece in a plasma processing chamber including a plasma torch;

translating at least one of the workpiece and the plasma torch; and

establishing an equilibrium in a plasma reaction in the plasma processing chamber, whereby material may be removed from the surface of the workpiece and redeposited on the surface of the workpiece with the discharge from the plasma torch.